

## Case Report

# Allergic to Pool Water

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To identify the allergy problem of a 36-year old swimming instructor, who experiences heavy itching and rashes whenever she comes in contact with pool water. Patch tests were performed with European standard series and materials from the work floor. A positive patch test to aluminum chloride and flocculant was observed. Occupational dermatitis is, based on a contact allergy to aluminum chloride in the flocculant.

**Key Words:** Pool water, Flocculant, Aluminum chloride, Allergic contact dermatitis

## Introduction

A 36-year old woman, working as a swimming teacher for 5 years, developed a work related skin complaint about a year prior to her visit. After contact with pool water itching started over her entire body and she experienced a rash. The time during her days off was initially long enough to let the skin heal, but not anymore at later stages. She herself suspects a relationship with an accident at the baby pool, in which at one point a high dose of flocculant was accidentally present. A few of her colleagues have since developed complaints as well. She describes her skin as sensitive because of easily irritation and sometimes there had been slight signs of eczema, disappearing without any special treatment.

## Case Report

Our patient works for 20 hours a week, of which about 3 hours a day she is actually in the water. The other hours are spent teaching lessons from the edge of the pool, cleaning the pool,

and other such activities. Within the 3 so-called water bound hours, 2 hours are usually continuous. She wears normal swimwear. During the lessons, the patient often uses a so-called flexi-beam, a floating device in the form of a colored, porous rod. These rods are usually damaged because of tearing and biting. She has got the impression that intensive contact with the flexi-beam aggravates her symptoms. The floors and bathrooms are cleaned with tap water. Chlorine measurements of the pool water are carried out once a week. She doesn't have contact with these chemicals.

**Skin care:** Nivea Q10 (Beiersdorf, Hamburg, Germany) Day, night crème, and regular hand soap.

**Predisposing skin factors:** Asthmatic symptoms run in the patient's family; the patient herself has never experienced atopic symptoms, not on the skin nor in the airways. This heritable burden could be the cause of her sensitive skin.

**Dermatologic investigation:** The patient has been unable to work for some time due to a tendon problem in her leg. Because of this, her skin symptoms have largely disappeared. What remains is a livid rest on the hands, with some indication of vesicular eczema.

Patch tests were carried out using the European standard series, a variety of rubber additives, (components of) externally used drugs, as well as care products, her own skin care products, Locron® (Clariant GMBH, Sulzbach, Germany), parts of the flexi-beam, and pool water from the different pools. Skin-

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prick tests were performed with the pool water from the different pools. Table 1 shows the results of these tests.

## Discussion

The contact allergic reaction to the perfume components and the preservative methyl (chloro) isothiazolinone, sufficiently clarify the reactions to her own cosmetic care products. However, they cannot clarify the skin symptoms after contact with pool water. P-phenylenediamine base is a component of hair dyes, and when asked, she confirms having experienced from symptoms after coloring her hair in the past. She had stopped this practice prior to the current symptoms. The role of formaldehyde in the symptom pattern is not completely clear. It may have been present as a preservative in a variety of skincare products, but it does not occur in pool water. At the moment, pool water does not seem to play a significant role.

Locron<sup>®</sup> L is a flocculant based on aluminum chlorohydrate. Aluminum chlorohydrates are a group of salts, under the general structure formula:  $Al_nCl(3_n - m)(OH)_m$ . In the form of flocculant, the structure formula is:  $Al_{12}Cl_{12}(OH)_{24}$ .

Pool contamination is taken out with the use of filters. Tiny particles can evade this by using the so-called Vander Waals force. They repel each other and by doing so remain too small to get stuck in the filter. Flocculants are added to pool water in order to nullify this force. The particles clot together and can be removed by the filters.

Aluminum chloride irritates the skin when used in high concentrations. In the medical literature, in order to patch testing for aluminum chloride, it is recommended for the chemical to be formulated as 5% in petrolatum and as well as 2% in

water [1-4]. With Locron<sup>®</sup> tested in a concentration of 2% in aqua, we remained below the irritating concentrations. Dilutions were tested with the pool waters as is, although we realize that we didn't know the exact concentration of Locron<sup>®</sup> in this pool water. We did not observe a positive reaction against Locron<sup>®</sup> (2% aqua) in 8 controls, all of whom were employees at swimming pools. This supports our opinion that, although there will be irritation from the water, the reaction is also based on a contact allergy. The fact that the skin test reaction became stronger in the first 72 hours matches that of a contact allergic reaction; an irritation reaction should decline after removal of the test substance.

Deodorants do have irritating effects, the concentration of aluminum chloride used there is usually around 20%.

We think our patient has been sensitized while working in the baby pool, when the concentration of flocculant was too high, although we have no proof for this accident. The positive patch test reaction to the flexibeam is probably due to the remainder of pool water in the porous material. It may be the combination of her sensitive skin, the irritative effect of being in the pool water for many hours and a contact allergy to the Locron<sup>®</sup>, which resulted in a rash.

The use of aluminum chloride in deodorants and antiperspirants is well known. When asked, our patient confirms that she develops dermatitis after using products containing aluminum chloride.

In conclusion, in the medical literature, health problems caused by pool water are mentioned, but the problems described are mostly located in the upper and lower airways [5,6]. Infections have been mentioned [7]. We know that skin problems are caused by pool water, but these problems are almost

**Table 1.** Reaction of patch and skin-prick tests

	15 minutes pricktest	48 hours patchtest	72 hours patchtest	8 days patchtest
P-phenylenediamine base	NT	+	+	-
Fragrance	NT	+	+	-
Methyl(chloro)isothiazolinone	NT	++	++	-
Formaldehyde	NT	++	++	-
Nivea <sup>®</sup> soft crème	NT	+	++	-
Nivea <sup>®</sup> Dnage crème	NT	+/-	+	-
Pool water (from all 4 seperately)	++	+/-	++	+/-
Flexibeam	+/-	+	++	+/-
Locron <sup>®</sup> flocculant (2% aqua)	NT	+	++	+

NT: not tested, -: negative reaction patch test/prick test, +/-: dubious reaction patch test/prick test, +: positive reaction patch test/prick test, ++: strong positive reaction patch test/prick test.

always the result of dry skin, an irritative reaction on sensitive, or eczematous skin. There is one publication on a contact allergy for chlorine in pool water [8]. As far as we know, contact allergy reactions to aluminum chloride in flocculants have not yet been published before.

Our case proves the importance of considering an allergy, even when it seems unlikely. It also proves that patch testing with materials from the workplace is indispensable. Our swimming instructor was not able to resume her work. There are no flocculants without aluminum chloride available.

### Conflict of Interest

No potential conflict of interest relevant to this article was reported.

### References

1. de Groot AC. Patch testing. Test concentrations and vehicles for 4350 chemicals. 3rd ed. Wapserveen (Netherlands): Acdegroot Publishing; 2008.
2. Kanerva L, Elsner P, Wahlberg JE, Maibach HI. Condensed handbook of occupational dermatology. Berlin-Heidelberg-New York: Springer Verlag; 2004. 528 p.
3. Frosch PJ, Menné T, Lepoittevin JP. Contact dermatitis. 4th ed. Berlin-Heidelberg-New York: Springer; 2006. 1136 p.
4. Clemmensen O, Knudsen HE. Contact sensitivity to aluminium in a patient hyposensitized with aluminium precipitated grass pollen. *Contact Dermatitis* 1980;6:305-8.
5. Font-Ribera L, Kogevinas M, Zock JP, Nieuwenhuijsen MJ, Heederik D, Villanueva CM. Swimming pool attendance and risk of asthma and allergic symptoms in children. *Eur Respir J* 2009;34:1304-10.
6. Voisin C, Sardella A, Marcucci F, Bernard A. Infant swimming in chlorinated pools and the risks of bronchiolitis, asthma and allergy. *Eur Respir J* 2010;36:41-7.
7. Schoefer Y, Zutavern A, Brockow I, Schäfer T, Krämer U, Schaaf B, Herbarth O, von Berg A, Wichmann HE, Heinrich J; LISA study group. Health risks of early swimming pool attendance. *Int J Hyg Environ Health* 2008;211:367-73.
8. Sasseville D, Geoffrion G, Lowry RN. Allergic contact dermatitis from chlorinated swimming pool water. *Contact Dermatitis* 1999;41:347-8.